



Results of Federal Cost-Shared Research: Better Understanding of Geothermal Resources

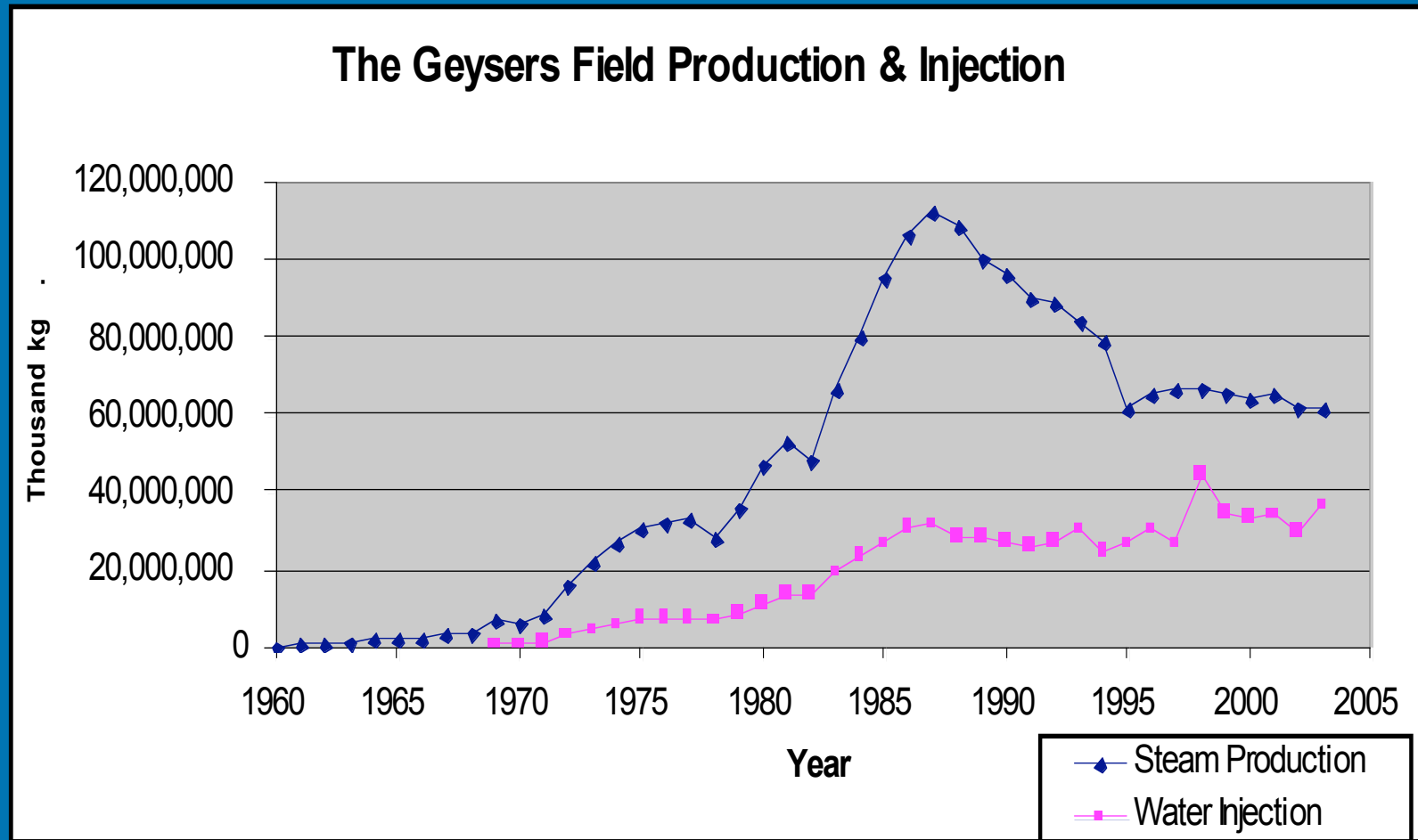
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U.S. Geological Survey

Understanding Geothermal Resources

- Conceptual Models, Temperature Profiles, Reservoir Geometry, Water Chemistry
- Location of Fractures, Fluid Flow Paths
- Interactive Reservoir Models, Optimum Location of Production and Injection Wells

The Geysers Field History



The Geysers Cooperative Research

- Will Increased Injection be Effective?
- What is the Optimal Location for Injection?
- Is there a Potential Source of Injection Water?

The Geysers Cooperative Research

Seismic Surveys

Temperature Gradient & Heat Flow Surveys

Core & Cuttings Analysis

Fluid Inclusions & Secondary Minerals

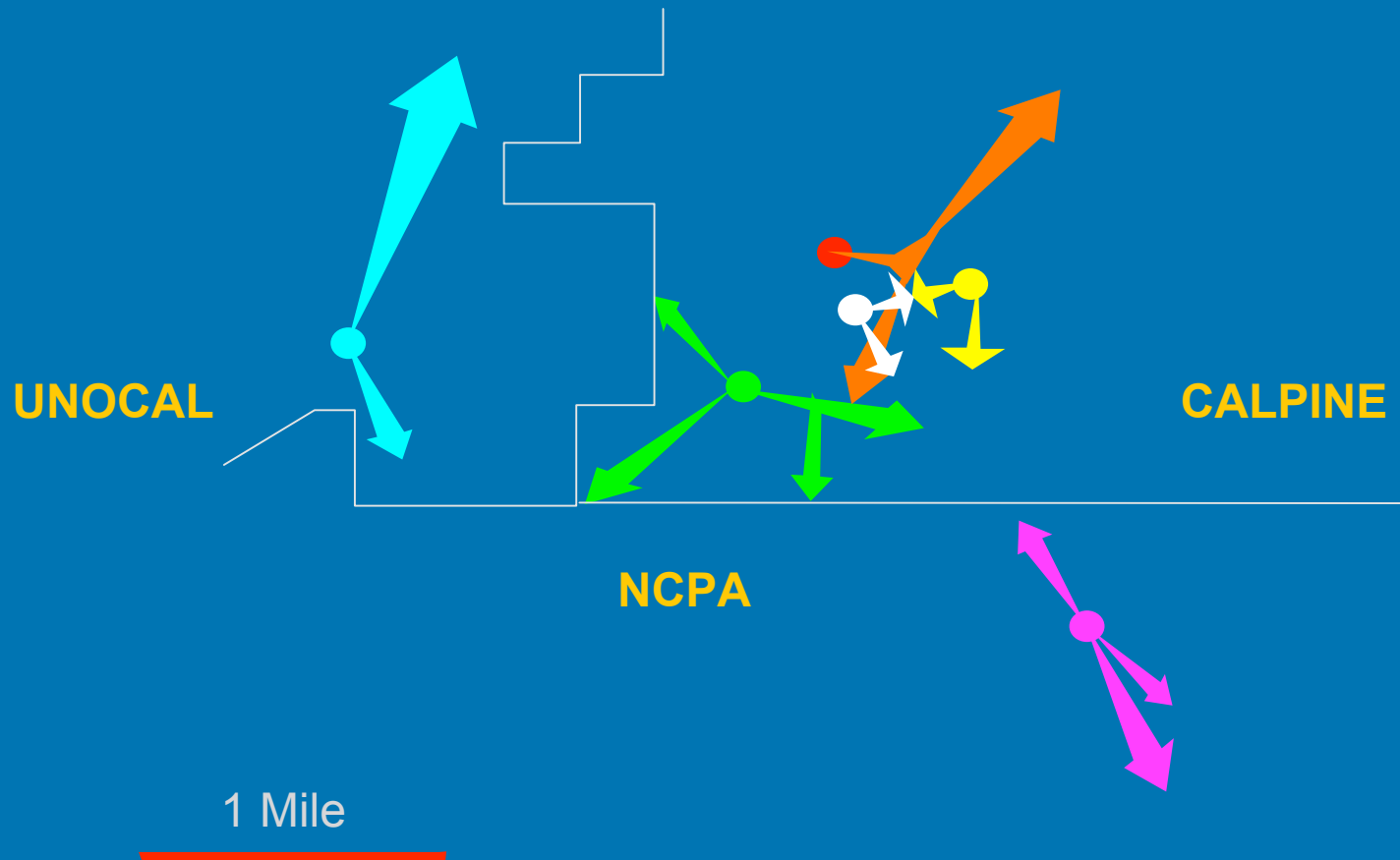
Tracer Tests

Injection Tests

The Geysers Tracer Test

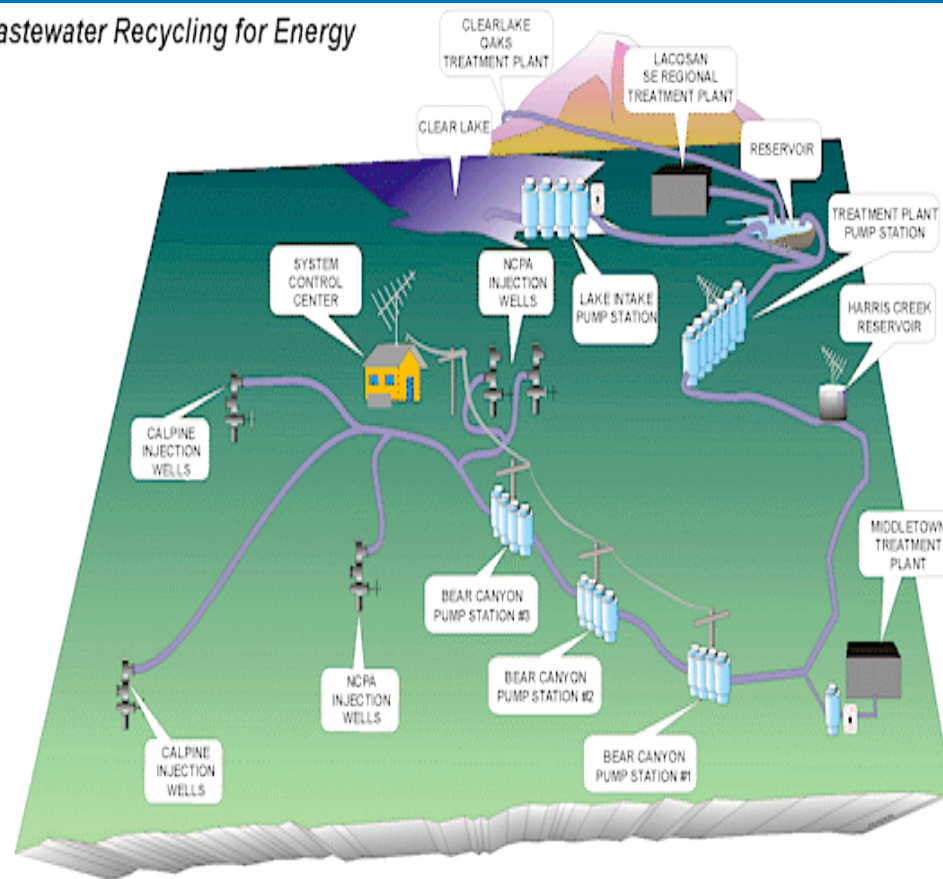


The Geysers Tracer Test

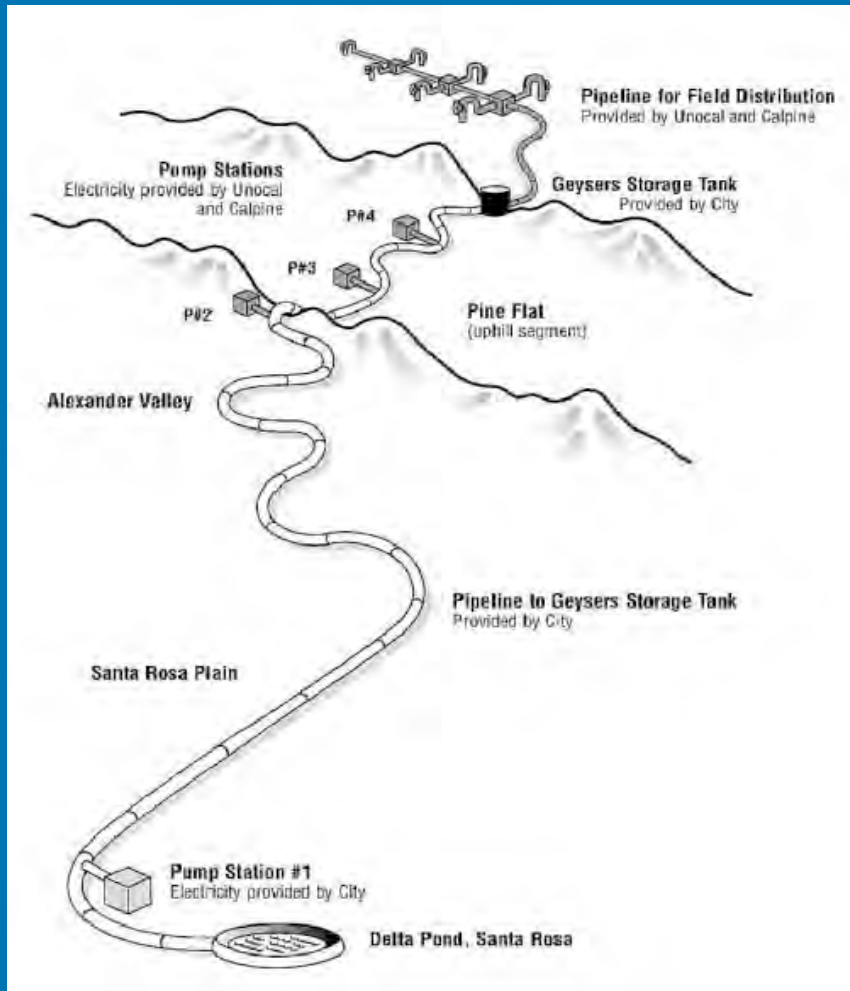


The Geysers Cooperative Research

Wastewater Recycling for Energy



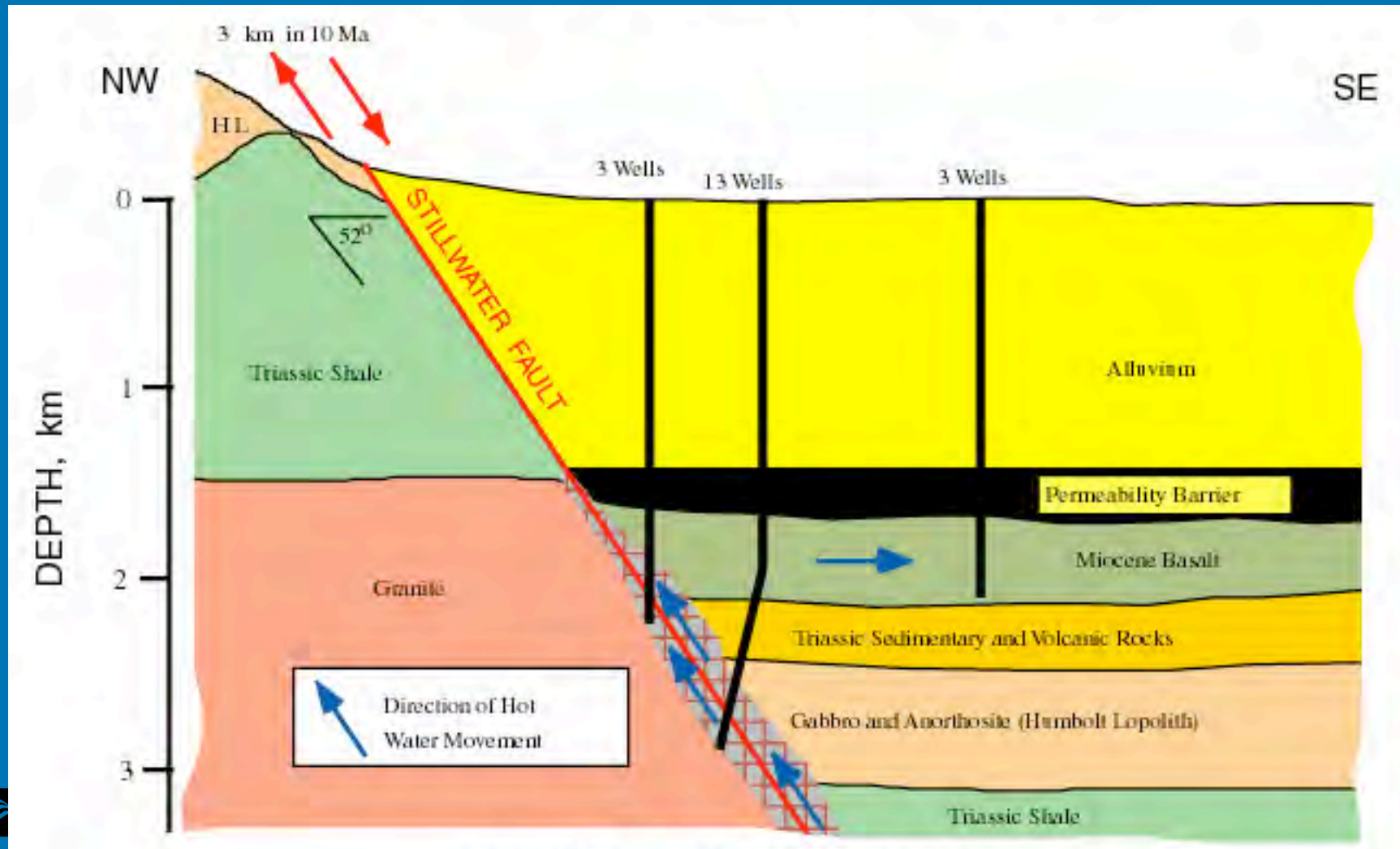
S.E. Geysers Injection System
Operating Since September 1997



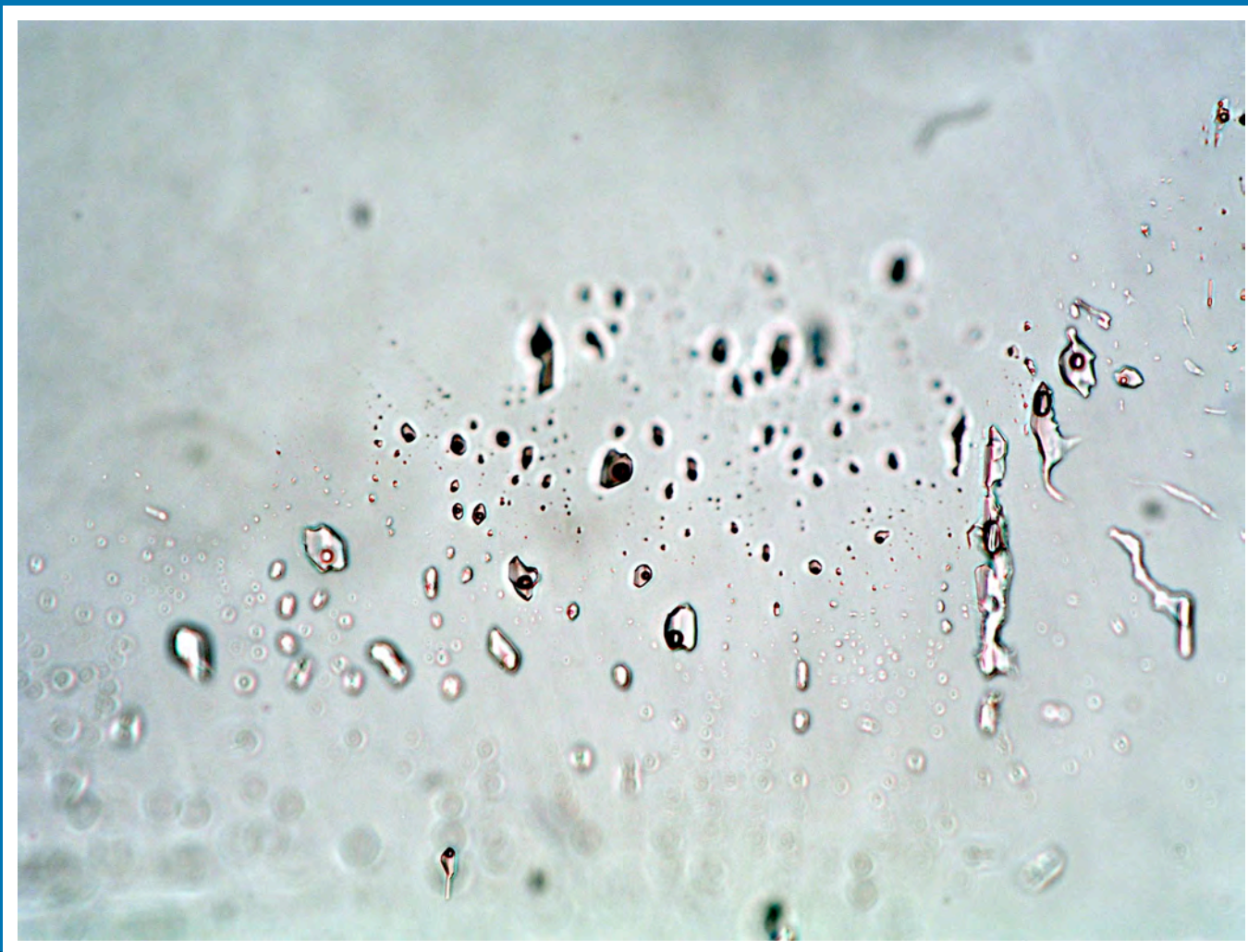
Dixie Valley Geothermal Field

- Why are Some Wells along the Fault Good Producers and Some are not?
- What is the Optimal Location for Injection?

Dixie Valley Geothermal Field

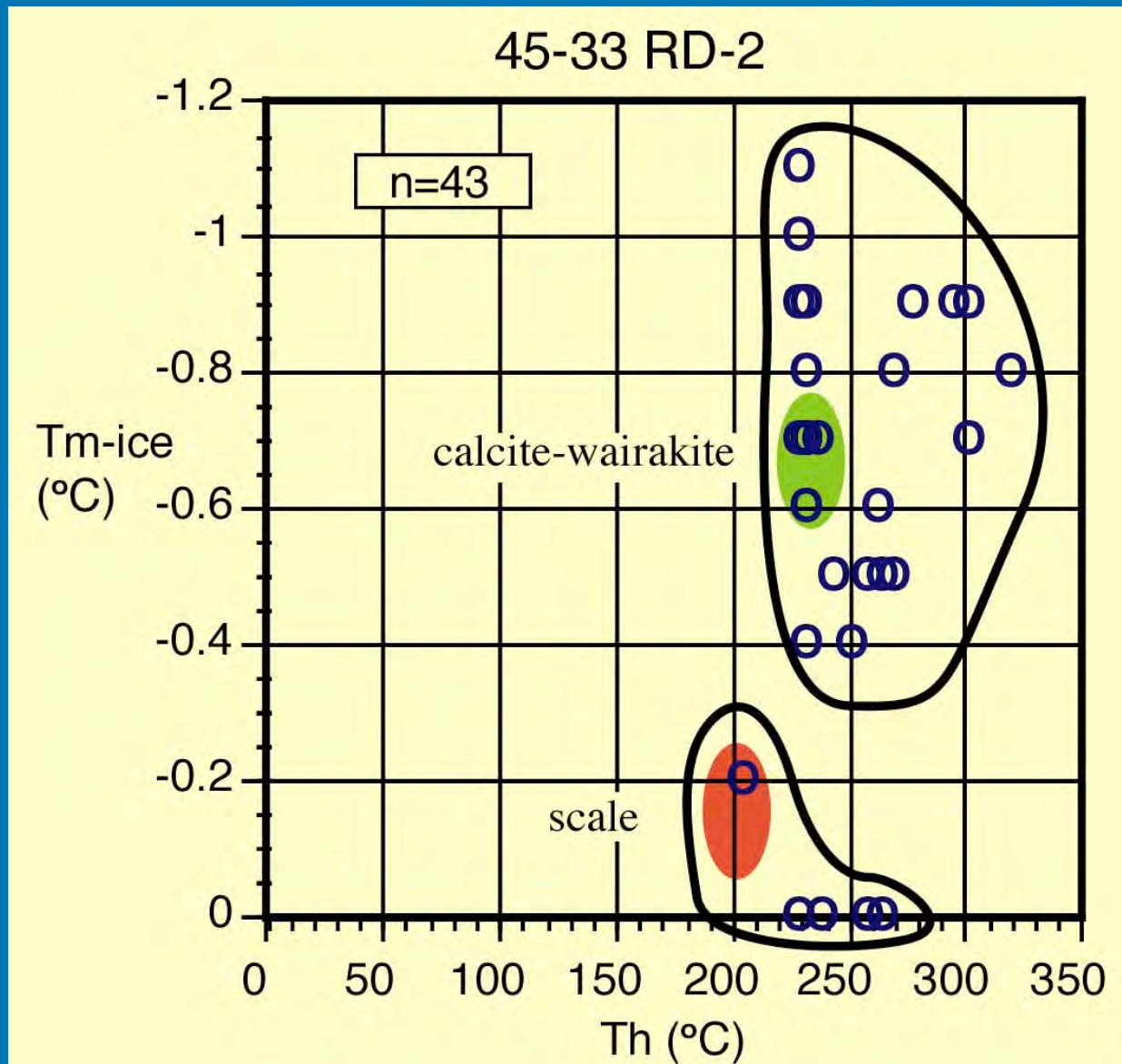


Fluid Inclusions



Dixie Valley Geothermal Field

Fluid Inclusion Temperatures and Salinity



DIXIE VALLEY GEOTHERMAL FIELD

0 2
scale, km

STILLWATER RANGE



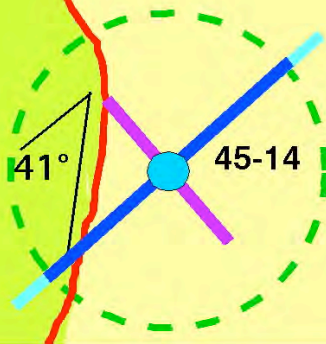
10°

73B-7,
82A-7 &
74-7

DIXIE VALLEY

KEY, WELLS:

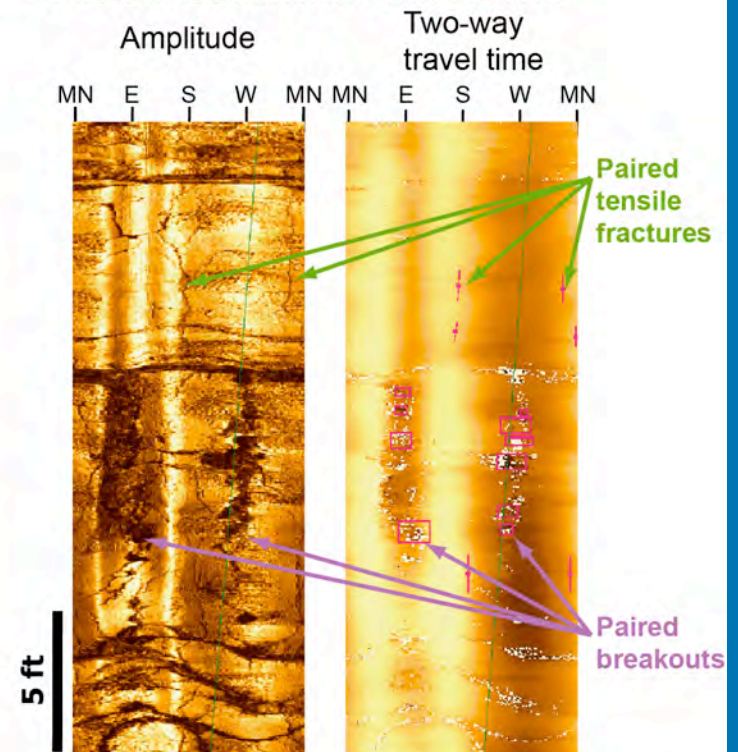
- PRODUCTION ($T \sim 1 \text{ m}^2/\text{min}$)
- OBSERVATION ($T \sim 10^{-4} \text{ m}^2/\text{min}$)



Magnitudes of S_{hmin} and S_{Hmax} shown relative to S_v (circles)

Borehole Televviewer

Stress indicators imaged by ABI85 Borehole Televviewer



Stress and fluid flow around active
Basin and Range normal faults



Cooperative Research Results

Seismic Surveys for Reservoir Structure

Temperature Distribution & Geometry

Borehole Imaging for Fractures

Core & Cuttings Analysis for Fluid Changes

Tracer Tests for Fluid Flow Directions

Injection Tests for Pressure Maintenance